Regression, correlation and hypothesis testing 1C

1 a H_0: $\rho = 0$, H_1: $\rho \neq 0$, critical value = ±0.3120. Reject H_0: there is reason to believe at the 5% level of significance that there is a correlation between the scores.

b H_0: $\rho = 0$, H_1: $\rho \neq 0$, critical value = ±0.3665. Accept H_0: there is no evidence of correlation between the two scores at the 2% level of significance.

2 a $r = -0.960$ (3 s.f.)

b H_0: $\rho = 0$, H_1: $\rho \neq 0$, critical value = ±0.8745. Reject H_0: there is reason to believe at the 1% level of significance that there is a correlation between the scores.

3 a The product moment correlation coefficient measures the type and strength of linear correlation between two variables.

b $r = 0.935$ (Get this value directly from your calculator.)

c

$$\left.\begin{array}{l} H_0 : \rho = 0 \\ H_1 : \rho > 0 \end{array}\right\} \text{ 1-tail } \alpha = 0.05$$

test statistic = 0.935

critical values = 0.4973

t.s. > c.v., so reject H_0.

Conclude there is positive correlation between theoretical Biology and practical Biology marks – this implies that students who do well in theoretical Biology tests also tend to do well in practical Biology tests.

d There is a probability of 0.05 that the null hypothesis is true.

4 a $r = 0.68556...$
so $r = 0.686$ (3 s.f.)
(NB. In the exam get this directly from your calculator. If you set up a table of results you are likely to run out of time.)

b H_0: $\rho = 0$, H_1: $\rho > 0$, critical value = 0.6215. Reject H_0: there is reason to believe that there is a linear correlation between the English and Mathematics marks.

5 $r = 0.793$
(NB. In the exam get this directly from your calculator. If you set up a table of results you are likely to run out of time.)

$$\left.\begin{array}{l} H_0 : \rho = 0 \\ H_1 : \rho > 0 \end{array}\right\} \text{ 1-tail } \alpha = 0.01$$

test statistic = 0.793

critical values = 0.8822

t.s. < c.v. so accept H_0.

Conclude there is insufficient evidence at the 1% significance level to support the company's belief.

6 H_0: $\rho = 0$, H_1: $\rho < 0$, critical value = −0.4409. Accept H_0. There is evidence that the researcher is incorrect to believe that there is negative correlation between the amount of solvent and the rate of the reaction.

7 The safari ranger's test.
Type: 1-tailed
$H_0 : \rho = 0$
$H_1 : \rho > 0$
Sample size: 10
$r = 0.66$
He has sufficient evidence to reject H_0. The corresponding part of the table reads:

0.10	0.05	0.025	0.01	0.005	Sample size
0.4428	494	0.6319	0.715	0.7646	10

Therefore the least possible significance level for the ranger's test is 2.5%.

8 The information from the question is as follows:
Type: 1-tailed
$H_0 : \rho = 0$
$H_1 : \rho > 0$
Sample size: unknown
$r = 0.715$.
He has sufficient evidence to reject H_0. Part of the corresponding column of the table reads:

PMCC at 0.025 level of significance	Sample size
0.9500	4
0.8783	5
0.8114	6
0.7545	7
0.7067	8

Therefore the smallest possible sample size is 8.

9 a $r = -0.846$ (3 s.f.)

b H_0: $\rho = 0$, H_1: $\rho < 0$, critical value = −0.8822. Accept H_0. There is evidence that the employee is incorrect to believe that there is a negative correlation between humidity and visibility.

10 a This is a two-tailed test, so the scientist would need to halve the significance level.

b ± 0.4438